

## THE ORIGIN OF A SYMPATRIC SPECIES IN *COLIAS* THROUGH THE AID OF NATURAL HYBRIDIZATION

WILLIAM HOVANITZ

[continued from volume 1, page 274]

### IV POPULATION ANALYSES FROM SIGNIFICANT REGIONS

Analysis of the variation of *Colias hecla*, *Colias nastes* and *Colias boothi* (where present) has been made at a large number of stations throughout arctic North America and at one station in northern Sweden. The North American stations are shown on the map (fig. 10) drawn for this purpose. Many of the stations shown are taken from the map drawn for the "Northern Insect Survey" of the Canadian Government and made available for this use by Dr. T. N. Freeman.

In addition to the localities which are taken from that map, some stations are shown which represent samples made by others. There are included a sample from the Meade River, Alaska made available by Dr. John Garth, a sample from Coppermine, Northwest Territories, collected by the author in 1947, a sample from Danske Island in the Hudson Bay made available by the Danish National Museum, Copenhagen, and a sample from Coral Harbour, Southampton Island, collected by Dr. G. M. Sutton and made available by the Carnegie Museum, Pittsburgh.

The analyses of the populations has been made by the two characters indicated in section III in this series, namely, by applying a numerical value to the grade of border pattern displayed by each specimen, and also by applying a numerical value to the grade or orange pigmentation displayed by each specimen. These two values for each specimen are then plotted on a scatter diagram, which gives a fair idea, on perusal, of the condition of the variation of the three species in any one locality. As the females all show the same border pattern for both species, this sex was rated by color only. These diagrams are indicated as figures 11 through 42. The method of grading the insects is described in section III and is illustrated in color in figures 8 and 9.



Fig. 9. Series of *Colias*, mostly identifiable as *C. boothi*, showing by means of a graded series, nine steps in the orange color development on the forewings of the male from the yellow at the top left to the full orange at the second to the bottom right. Grades are designated as 0 through 4 on the left column and 5 through 9 on the right column. The specimen on the bottom right does not enter the series but is shown to illustrate a variation in which the fore wings are orange and the hind wings yellow. All specimens shown are males. All are from Coppermine, Northwest Territories, Canada, July 12-19, 1947, W. Hovanitz coll. except (1) grade 0, top on left column, Repulse Bay, Northwest Territories, Canada, Aug. 2, 1950. P. F. Bruggemann, (2) Grade 8, fourth from top on right column, Repulse Bay, N. W. T., Canada, July 27, 1950. J. E. H. Martin.

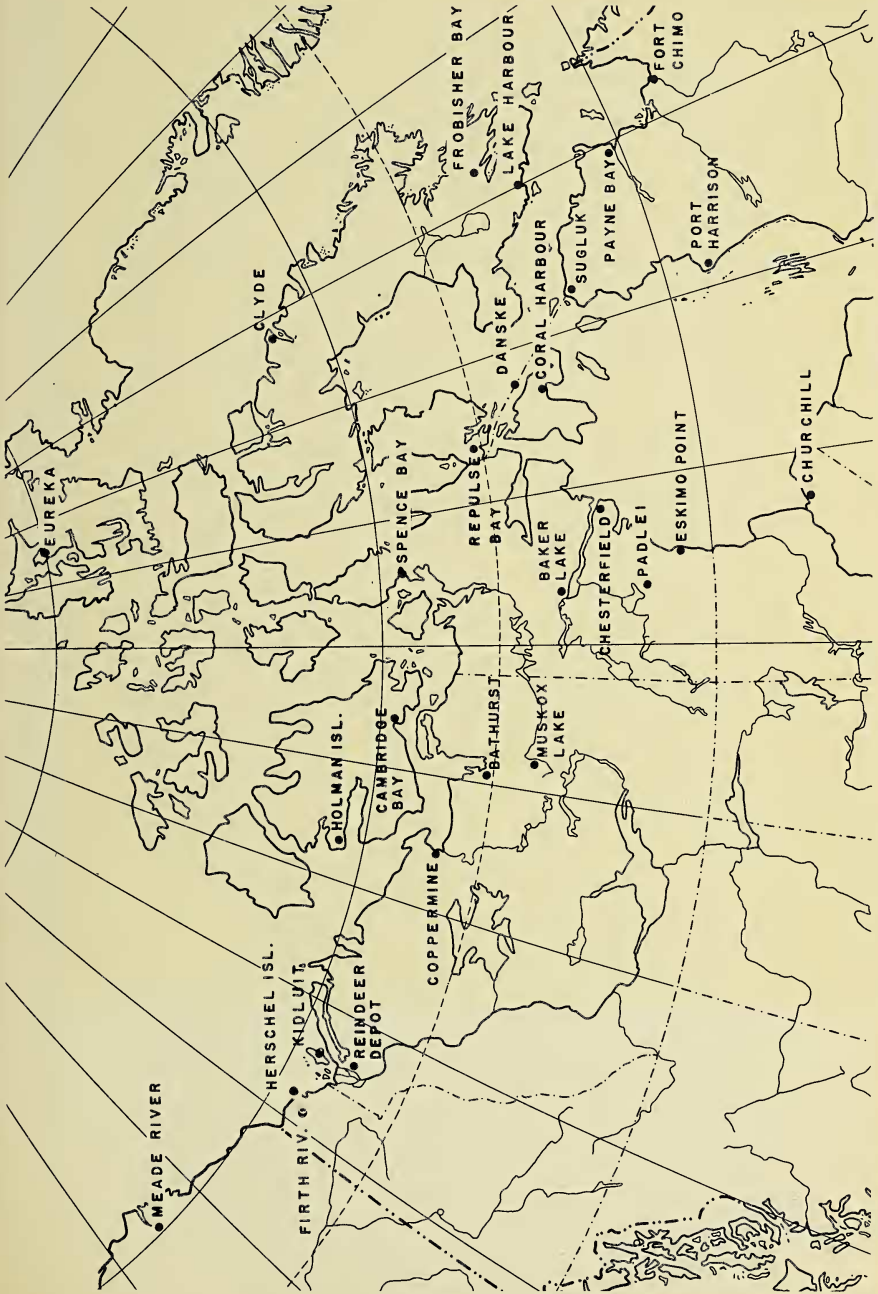
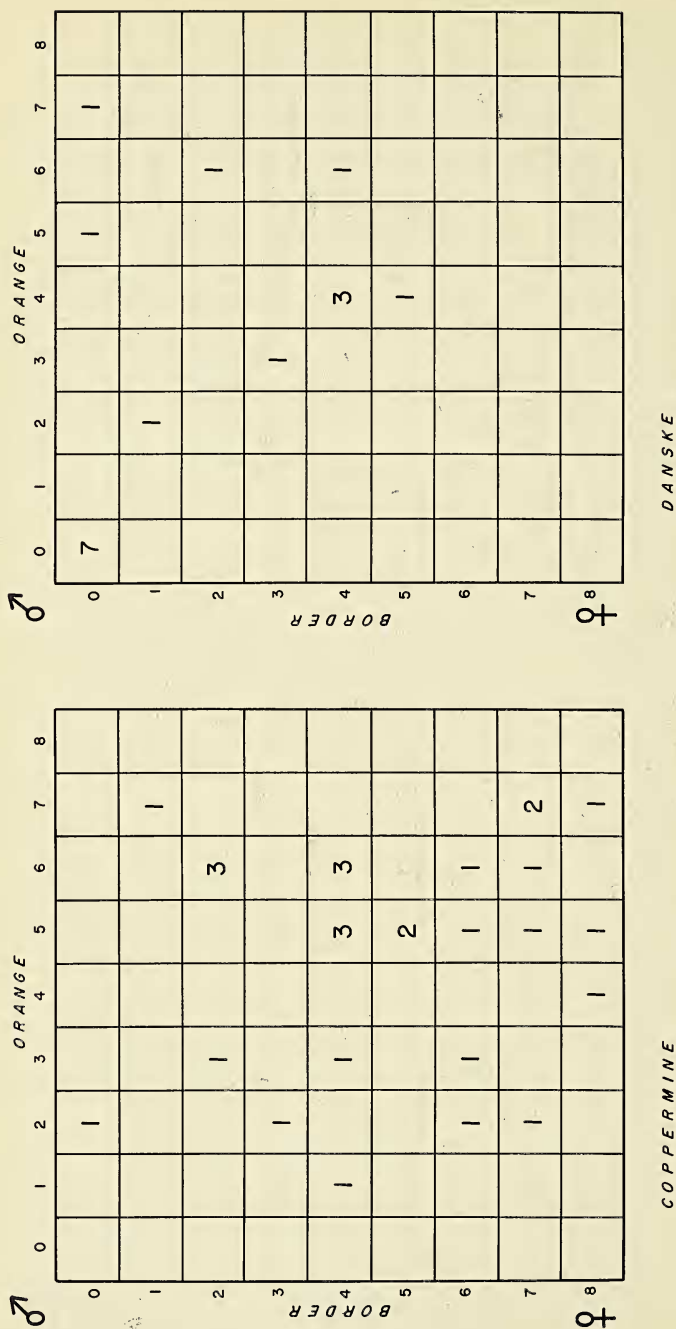
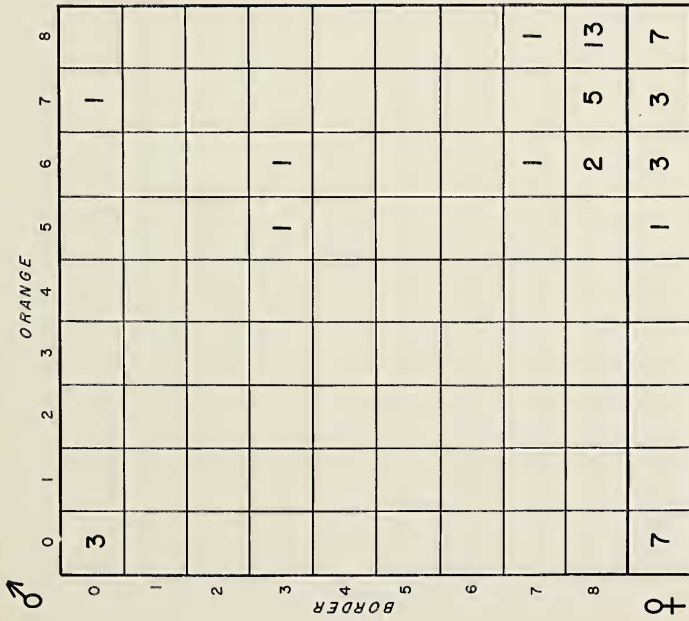
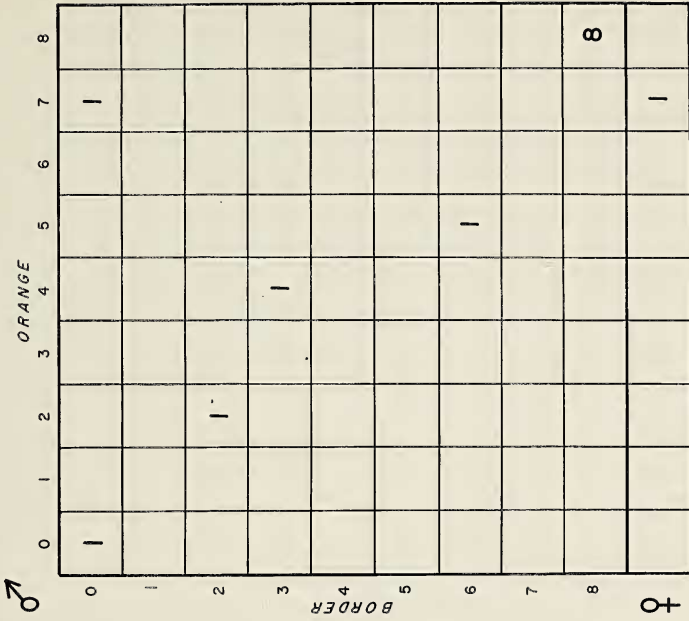


Fig. 10. Map showing locations where samples of *Colias hecla*, *Colias nastes* and *Colias boottii* have been analyzed.





Figs. 11-42. Diagrams illustrating the range of variation in the populations of *Colias* which have been graded for two characters.



[illegible]

FORT CHIMO

♂	0	1	2	3	4	5	6	7	8
0	35	17			1			1	
1									
2									
3									
4		1							
5					1				
6									
7									
8									
♀	7	9	3	2	3	2			

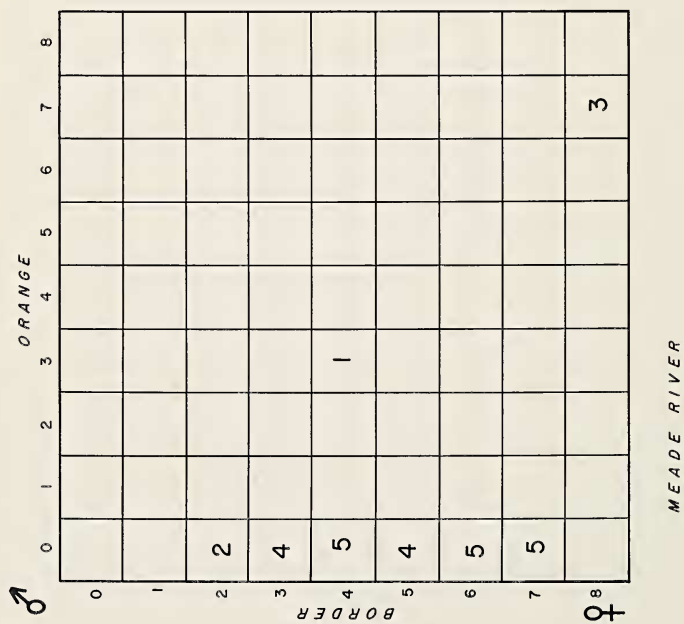
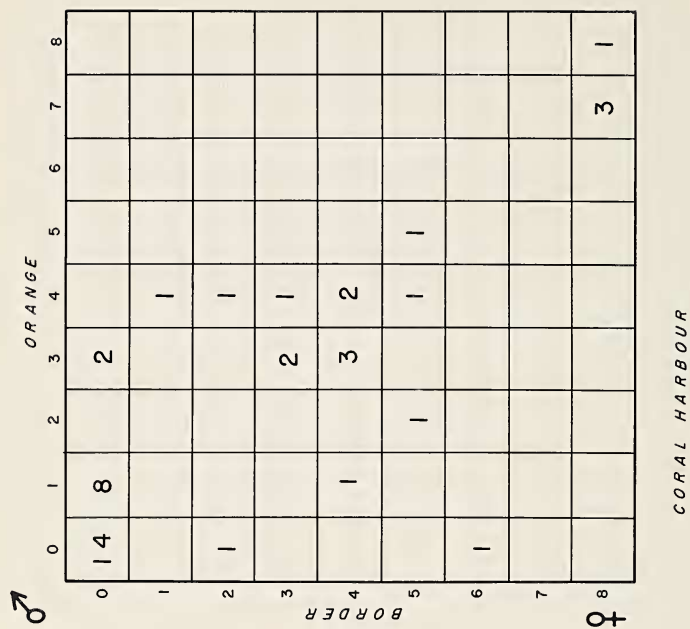
CORAL HARBOUR

♂	ORANGE									♀
	0	1	2	3	4	5	6	7	8	
0	30	12		2	2		1	1		
1	1	3	3	2	2	3	1	2		
2			1	1	2	6	1			
3		1	1	3		1	1			
4		1			1					
5	1									
6		1			1					
7										
8							1	40	7	
	6	4	5	3	4	1	2	3	3	

SPENCE BAY

♂	ORANGE									♀
	0	1	2	3	4	5	6	7	8	
0	112	26	3	2	2	2				
1	5	1	1	1	3	2	3	1		
2	3		1	1	2	3				
3	1	1	1		1	1	1			
4	1									
5	1	1					1			
6		1								
7										
8									15	
	32	11	6	7	3	3	2	2	5	

CORAL HARBOUR





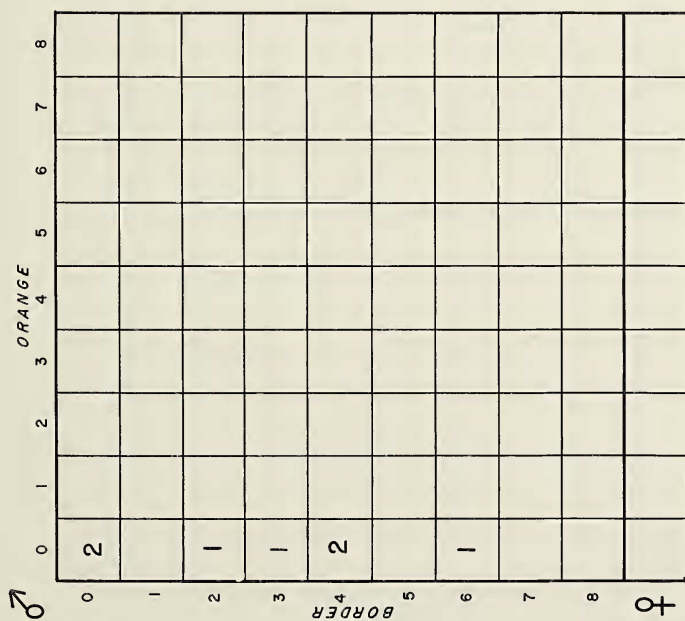
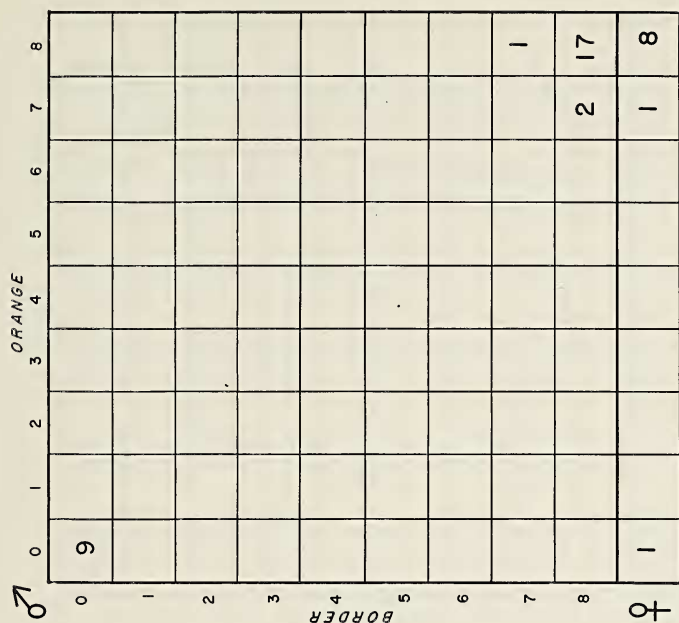


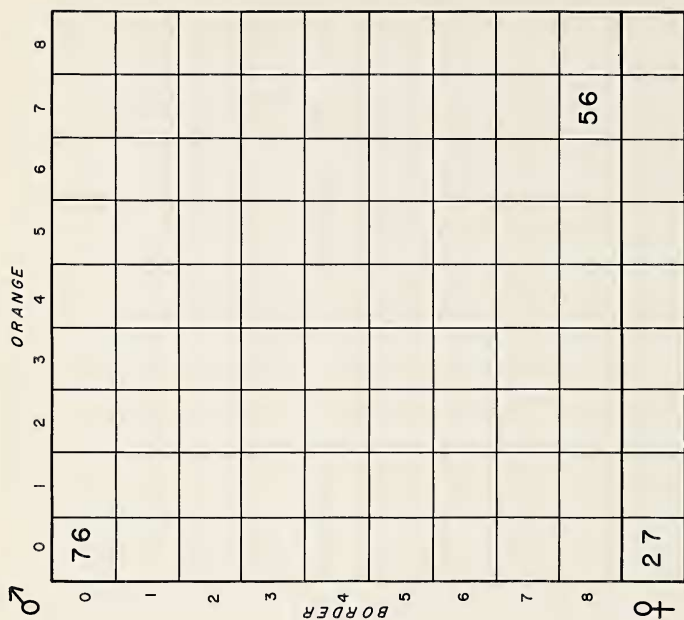
♂	ORANGE									♀
	0	1	2	3	4	5	6	7	8	
0	27	1								
1	8	1								
2	2									
3	2									
4	1									
5	4									
6	1									
7	2									
8								— 6 —		
	11	1								

CAMBRIDGE BAY

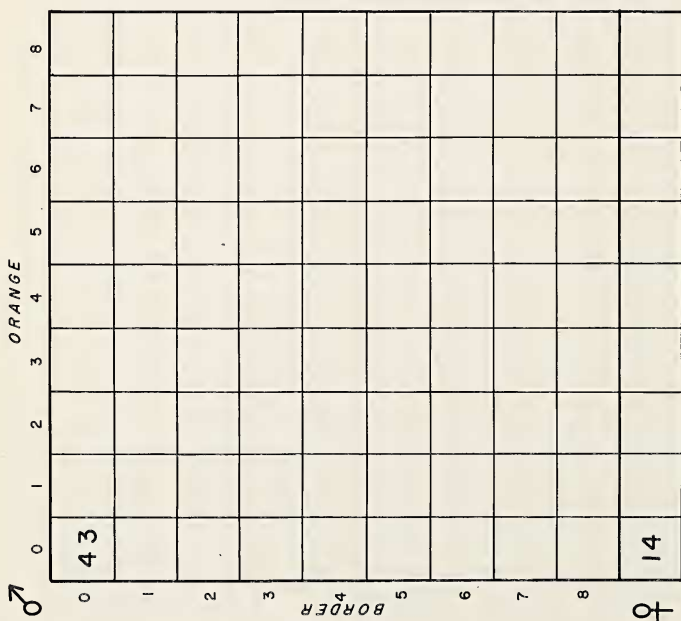
♂	ORANGE									♀
	0	1	2	3	4	5	6	7	8	
0	13									
1										
2										
3										
4										
5	1									
6	1									
7	1									
8						1			3	
	5									

HOLMAN, VICTORIA IS.





HERSCHEL ISL.



CHURCHILL

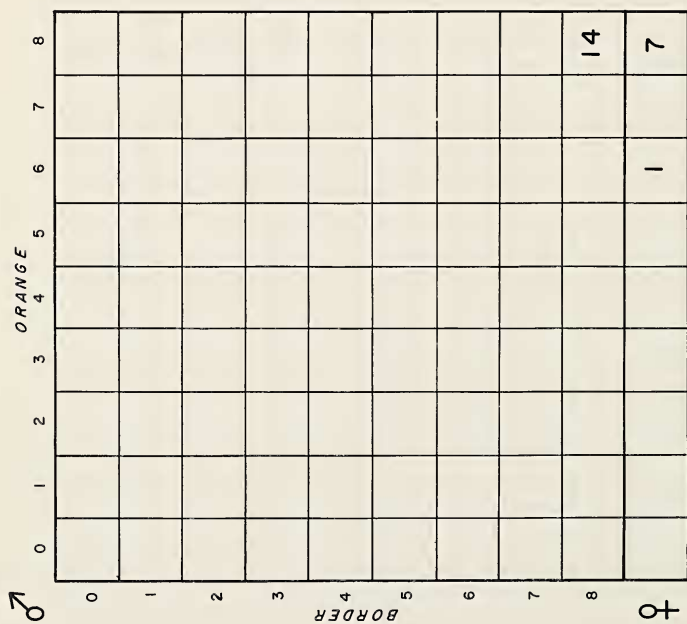
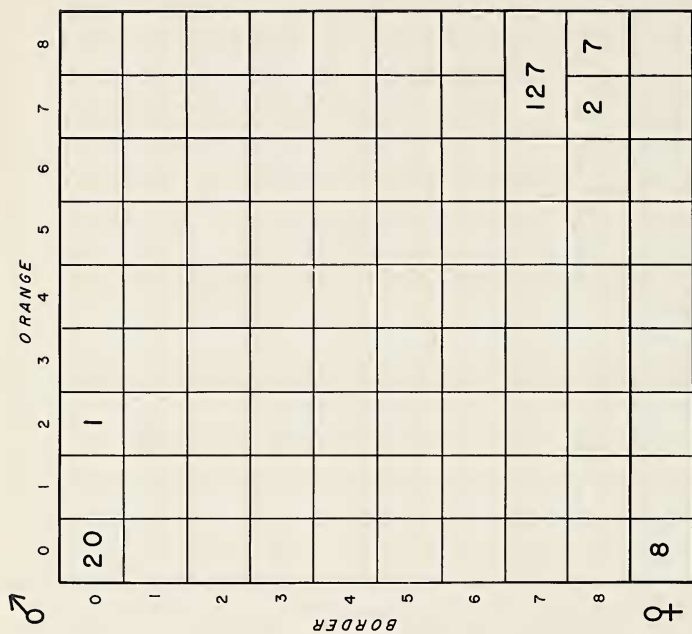
♂	ORANGE									♀
	0	1	2	3	4	5	6	7	8	
0	24						1			
1						2		4	3	
2							2	1	2	
3								2	1	
4									1	
5						1				
6							2	7	4	
7							2	9	5	
8								1	5	57
		1								
			1	1	1	4	2	6	10	

CHESTERFIELD

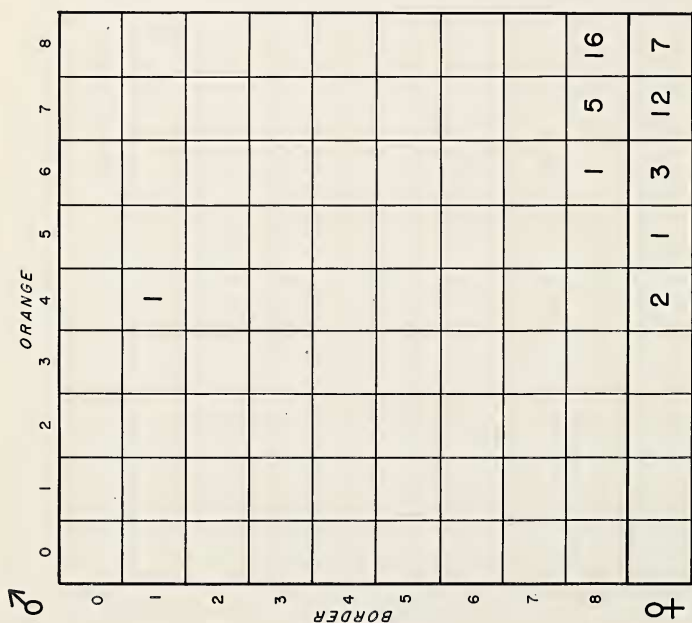
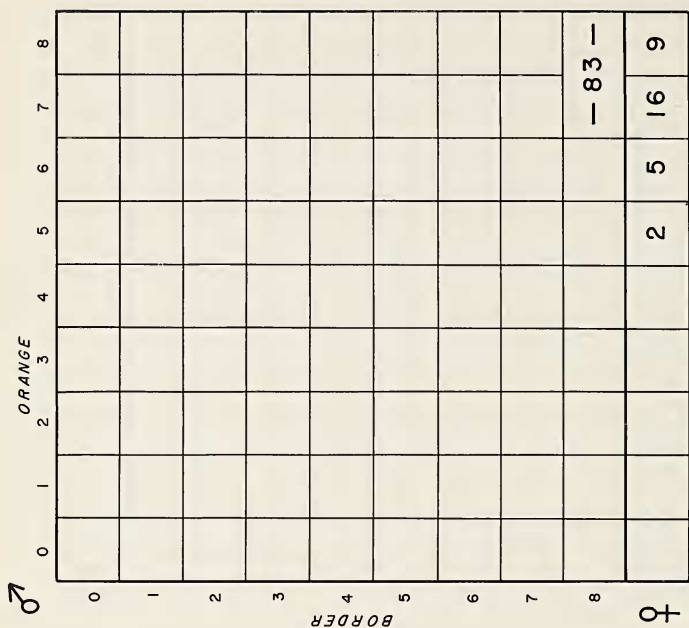
♂	ORANGE									♀
	0	1	2	3	4	5	6	7	8	
0	81	1		1	1	1		1		
1	1	1								
2										
3								1		
4								1		
5										
6									3	
7								1	5	
8						1		3	57	
	28	1	1	1	2	2	1	5	26	

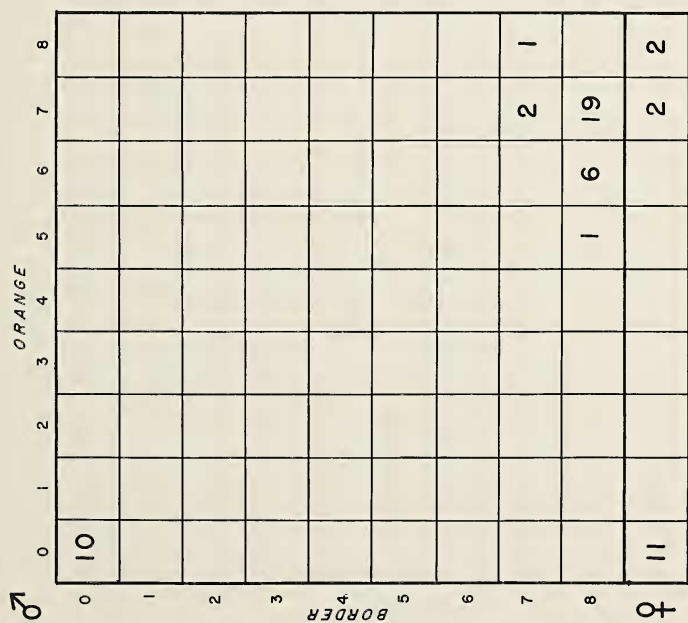
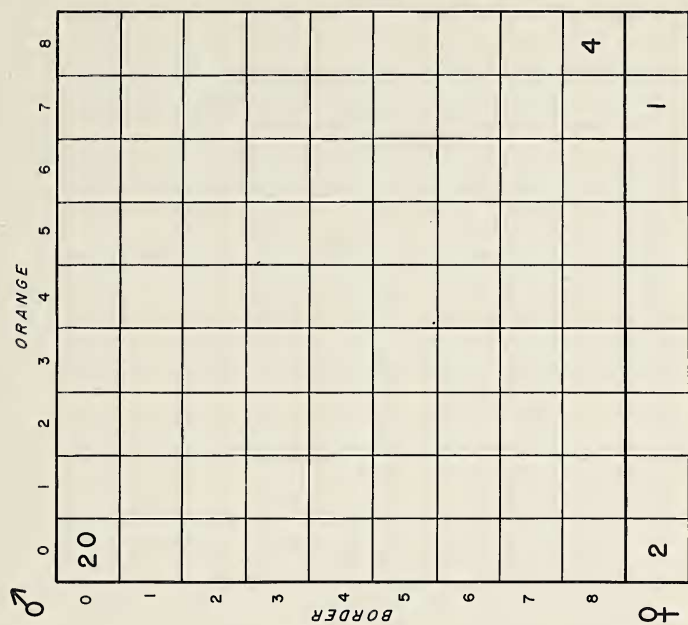
ESKIMO PT.











♂

	0	1	2	3	4	5	6	7	8
ORANGE									
BORDER	0	1	2	3	4	5	6	7	8
0									
1									1
2									
3								1	
4								1	
5									
6								1	2
7								4	5
8								2	3
♀					2	1	1	3	3

PADLE I

♂

	0	1	2	3	4	5	6	7	8
ORANGE									
BORDER	0	1	2	3	4	5	6	7	8
0	45	2					1		1
1									1
2					1				1
3									1
4								2	1
5									3
6									4
7							1	4	11
8						1		1	2
♀	3	2		1		5	5	4	1

BAKER LAKE



♂	ORANGE									♀
	0	1	2	3	4	5	6	7	8	
0									1	
1										
2								1		
3										
4										
5										
6										
7								1		
8										
									1	

KEEWATIN

♂	ORANGE									♀
	0	1	2	3	4	5	6	7	8	
0	114	2	1	2	1	1	2	1		
1	1	2	1	2	2	5	5	3	1	
2		4	2	7	7	5	4	2		
3			3	9	5	5	3	3		
4			4	1	4	3		1		
5		1	2	1	2	2	1			
6		2	4	3	2	2	1			
7			2	2	1		1	1		
8								12	45	
	38	13	14	8	13	10	6	5	19	

REPULSE BAY